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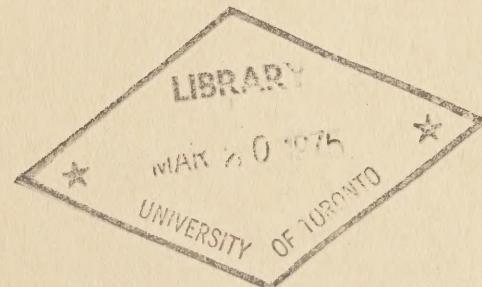
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[s] ENERGY IN ONTARIO: ECONOMIC BACKGROUND
ONTARIO BACKGROUND PAPER

15TH ANNUAL
PREMIERS' CONFERENCE
SEPTEMBER 12-13 1974



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ENERGY IN ONTARIO: ECONOMIC BACKGROUND
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15th Annual
Premiers' Conference
September 12-13 1974

Office of Economic Policy
Ministry of Treasury, Economics
and Intergovernmental Affairs

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SUMMARY

Petroleum provides just over 40 per cent of the province's total energy supply, natural gas and coal about 20 per cent each, hydro electricity 18 per cent and nuclear power the remainder. Ontario is dependent on sources from outside the province for about 80 per cent of its energy supplies.

A recent forecast by the Advisory Committee on Energy indicates that Ontario's energy demand will increase by about 60 per cent from 1970 to 1980, and that by 1990 it will be about $2\frac{1}{2}$ times the 1970 level. Problems and prospects of meeting the forecast increase are reviewed in this paper.

Petroleum:

Nearly all of Ontario's petroleum requirements come from western Canada. Given the fact that oil from Arctic or eastern offshore sources is not likely to be available before 1985, and that production from conventional reserves in the western provinces will peak about 1977, the nation is likely to suffer a shortfall in self-sufficiency from about 1978 to 1985, even if exports to the U.S. are drastically cut back. The national shortfall can be alleviated, but it is not likely to be completely eliminated, by synthetic oil from Alberta.

Natural Gas:

Ontario currently accounts for about one-half of the natural gas entering into final consumption in Canada. Almost all of the province's supply comes from Alberta, which will continue as the major supply source over the near term. With the exportable surplus already eliminated, the question arises as to whether the deliverability of western Canadian reserves can sustain minimal growth levels until frontier supplies become available. Over the long run, new sources of supply could include the Mackenzie Delta, the Arctic Islands and possibly the east coast offshore.

Coal:

About half of Ontario's annual consumption of 18 million tons of coal is used for power generation, and is imported from Pennsylvania and West Virginia. With Ontario Hydro's requirements expected to double by 1978, it has become necessary to look to other sources of supply. A test program using western Canadian coal is currently underway. If found technically suitable for Hydro's stations, Ontario can draw upon the very large reserves of Saskatchewan, Alberta and British Columbia totalling 118 billion tons. The anticipated higher cost levels as compared to U.S. coal, and the large capital outlays required to move the product to Ontario would be counterbalanced by security of supply.

Nuclear Power:

Ontario Hydro plans to have an installed nuclear generating capacity of 10,000 megawatts, costing about \$5 billion, by 1983. Forecasts indicate that by the end of the century installed capacity will have

increased over the 1983 level by a factor of 5 to 6. At that point, more than 60 per cent of the province's generating capacity will be nuclear.

Although Canada possesses a significant portion of world uranium reserves, expected increases in demand by the international market dictate that long-term domestic needs be assured. Accordingly, steps are underway to ensure requirements will be met.

Hydro Electricity:

In 1960 Ontario Hydro's generating capacity was made up almost entirely of hydro electric stations, but by 1972 hydro electric sources accounted for little more than half of output.

The only significant undeveloped hydro electric site remaining -- the Albany River -- is believed not to be economic at this time. Other remaining potential sites are likely to be economic only if developed for peaking purposes.

INTRODUCTION

This paper provides background information on energy in Ontario, particularly in relation to future inter-regional economic development.

About 80 per cent of Ontario's energy supply originates from outside the province. The remaining 20 per cent is accounted for by that part of electricity supply generated from indigenous water power and uranium.

At present, slightly over 40 per cent of total energy supply is derived from oil, and close to 20 per cent from natural gas. Coal accounts for a further 20 per cent, and the remainder is provided by hydro sources -- about 18 per cent -- and the small, but rapidly growing, nuclear power program.

Studies by Ontario's Advisory Committee on Energy, published in 1972, indicate that Ontario's energy demand will increase at an overall annual rate of 4.6 per cent for the rest of this decade and that by 1980 requirements will be 3,700 trillion BTUs, nearly 60 per cent more than in 1970.¹ By 1990 it has been forecasted that demand will have increased to almost two and one-half times the 1970 level, or to 5,700 trillion BTUs.

¹ Ontario Advisory Committee on Energy, Energy In Ontario, The Outlook and Policy Implications, Volumes One and Two (Toronto:1973)

The A.C.E. (Advisory Committee on Energy) studies concluded that oil and natural gas, while still increasing until 1980, will likely decline slightly in relative importance over the years following, while coal and hydro are already declining at a somewhat greater rate. The relative decline in use of the latter two sources will be counterbalanced by a dramatic increase in energy from nuclear sources. It should be noted that the A.C.E. report was completed prior to the recent rapid escalation of petroleum prices; accordingly, its conclusions regarding the relative importance of coal in the future may be reassessed.

ONTARIO ENERGY SUPPLY, 1970-1990
(Per Cent of Total)

Table 1

	<u>Oil</u>	<u>Natural Gas</u>	<u>Coal</u>	<u>Hydro</u>	<u>Nuclear</u>	<u>Other</u>	<u>Total</u>
1970	40.7	18.7	21.3	18.3	0.6	0.4	100.0
1980	41.9	27.0	10.8	10.3	9.8	0.2	100.0
1990	38.0	25.0	6.5	6.5	23.9	0.1	100.0

Source: Ontario Advisory Committee on Energy, Energy in Ontario, The Outlook and Policy Implications, Vol. I, December 1972.

DEMAND CHARACTERISTICS

On the demand side, energy use, as of 1970, was divided among:

Residential and Commercial	26.6%
Industrial	29.8%
Transportation	16.8%
Conversion Loss and Own Use	26.8%

Energy sources of the several demand sectors are approximately as follows:

Residential and Commercial

As noted, demand from the residential and commercial sector accounted for 27 per cent of total energy use in 1970. Of this, three-quarters was required for space heating and the remainder was consumed mainly in electrical and gas appliances.

For space heating, oil consumption has grown steadily and, until recently, gas consumption has increased very rapidly. Space heating by electricity forms a very small part of fuel use for this sector, and use of coal is small and declining rapidly.

Industrial

The great bulk of the nearly 30 per cent of total energy input to the industrial sector is accounted for by manufacturing.¹

Specific energy uses in the sector include:

- a) space heating;
- b) electrical energy for lighting and motive power;
- c) applications such as process steam production and metallurgical furnaces.

In terms of BTUs, oil accounts for just over 30 per cent of industrial sector consumption and natural gas for slightly less than 30 per cent. Electricity accounts for a further one-quarter and coal for almost all of the remaining 17 per cent.

¹ For a detailed analysis of manufacturing energy use, Energy Consumption by Ontario Manufacturing Industries, Ontario Economic Papers (Ministry of Treasury, Economics and Intergovernmental Affairs, Toronto: 1974).

Transportation

The approximately 17 per cent demand arising from the transportation sector was met entirely by petroleum products -- gasoline, diesel and aviation fuels.

Conversion Loss and Own Use

Of the roughly 27 per cent of total demand falling in the above categories, by far the largest component is the loss involved in conversion of fossil and nuclear fuels to electricity. The loss in conversion of crude petroleum to refined products is also of significance.

SUPPLY PROSPECTS

Prospects for further development of petroleum, natural gas, coal, nuclear energy and hydro electricity are as follows:

Petroleum

Ontario's petroleum supplies are derived from western Canada sources, with the exception of a relatively small part of provincial demand met from imported crude refined in Montreal. Because western Canadian production of conventional crude oil is expected to peak in 1977 at about 2.0 million barrels per day (and with production from synthetic crude and pentanes increasing the total to 2.2 million per

day), Canada, by 1979, would just be able to meet its own requirements (2.0 to 2.5 million barrels per day).

In 1973, Canada exported about 1 million barrels per day to the U.S. from the west, and imported about 800,000 barrels per day into Quebec and the Atlantic provinces. Although the capacity for self-sufficiency is present, the transportation network to move supplies to Quebec and the Atlantic Region does not exist. On the basis of present known reserves of conventional crude, not only would Canada nominally be just able to meet its own requirements by the late 1970's only by significantly cutting exports to the U.S. but also, starting about 1980, Canada will need to add production capacity of about 175,000 barrels per day per year to meet projected increases in domestic needs.

Constructing one synthetic oil plant each year, at a cost of over \$1 billion, would add 125,000 barrels per day to annual capacity. Not only would there be major problems of manpower availability and construction materials supply, but even adding one plant per year would still not be sufficient to meet total Canadian requirements. Furthermore, oil has not yet been found in sufficient quantities in the Arctic regions of Canada to justify a pipeline. It seems unlikely that oil can be moved from the Arctic before 1985. In sum, it seems likely that Canada will suffer a shortfall in self-sufficiency within this decade to at least 1985.

Natural Gas

Of the total 2,929.1 billion cubic feet of natural gas produced in Canada in 1972, 1,007 billion was exported, 776 billion was accounted for as pipeline fuel, shrinkage and losses, and the remaining 1,146 billion entered into end consumption in Canada. Of the latter figure, Ontario accounted for 552.8 billion, or almost half the Canadian end consumption.

Alberta, with 81 per cent of Canadian production in 1972, provided almost all of Ontario's supply. Gas is supplied to Ontario's three prime distributors -- Consumers Gas, Union Gas, and Northern and Central Gas (Ontario Division) -- by TransCanada Pipe-Lines under long-term contracts.

Over the near term, the major source of additional gas supplies for Ontario will continue to be the western Canada sedimentary basin. However, as of now, existing export commitments and growing domestic demand cannot both be sustained. Over the medium term, an emerging major concern is whether the deliverability of western Canadian reserves can sustain domestic growth levels until such time as it is possible to augment supplies from frontier areas or from synthetics.

Over the long run, sources of new gas supplies could include the Mackenzie Delta, the Arctic Islands, and possibly the east coast offshore.

The proposed Gas Arctic pipeline would deliver more than 4 billion cubic feet per day, with half its supply coming from the Mackenzie Delta and half from the Alaskan North Slope. Total capital cost is estimated at \$5 billion.

The proposed Polar Gas pipeline would involve 3,200 miles of line up to 48 inches in diameter, delivering 4½ billion cubic feet per day from the Arctic Islands. The estimated cost is between 5 and 6 billion dollars.

In the case of both projects, sufficient reserves to support production have not yet been discovered.

Coal

Ontario currently consumes about 18 million tons of coal annually, of which 50 per cent is used for generation of electricity, and practically all of the remainder is used by industry. Almost all of Ontario's supply is imported from the U.S., primarily West Virginia and Pennsylvania.

It is expected that consumption of coal for electrical generation will increase considerably over the near future. Ontario Hydro estimates that by 1978 its requirements will double to 18 million tons.

The possibility of increasing contractual supplies from West Virginia and Pennsylvania from the current level of 9 million tons to

12 million tons per year by 1978 is being examined. Even if this can be arranged, it will leave an additional requirement of between 5 and 6 million tons per year by 1978.

Consideration is being given to meeting Hydro's additional requirements to 1978 and beyond by western Canadian coal. Although use of domestic coal indicates greater security of supply, it also entails a number of new technical and financial aspects. First, it is expected that western Canadian coal could cost significantly more than U.S. coal. Secondly, although the western Canadian product has a much lower sulphur content than Hydro's imported coal and is consequently more desirable from the environmental point of view, it also has a considerably lower BTU/lb. rating. This means either a penalty on output, when used in existing generating stations, or upgrading by burning the coal in conjunction with oil or gas.

A test program utilizing western coal is being carried out during 1974. An order for 250,000 tons has been placed with a south-eastern B.C. colliery, and negotiations are underway for 250,000 tons from Alberta. These coals will be tested in thermal stations at Lambton, Nanticoke, Lakeview and Thunder Bay.

Volume shipments from western Canada would require significant capital investment -- unit trains to the Lakehead, and construction of trans-shipment facilities at the Lakehead. Investigations of costs and feasibility are progressing.

Although Canadian coal production in 1972 was limited to 20.7 million tons, reserves are very large. Of a total of 118 billion short tons, 59 billion are located in British Columbia, 47 billion in Alberta, and about 12 billion in Saskatchewan. About 30 billion tons of the total reserves are thermal coals, including the highly volatile bituminous, non-coking coals in British Columbia and the Alberta Foothills, the Alberta sub-bituminous coals and the Saskatchewan lignites.

The only proven reserve of coal in Ontario that can be considered potentially economic is the Onakawana lignite deposit between Cochrane and Moosonee. Some consideration is currently being given to a proposal to use this deposit to fuel a 900 MW generating station.

Nuclear Energy

Ontario Hydro currently has an installed capacity of about 2,000 megawatts of nuclear generation at Pickering. A further 3,000 megawatts are under construction at Bruce. In addition, plans for doubling the capacity of the two stations -- another 2,000 megawatts at Pickering and 3,000 megawatts at Bruce -- have been announced. The current estimate of costs for the existing and planned units, to be completed by 1983, is nearly \$5 billion.

Forecasts indicate that, by the end of the century, Ontario's installed nuclear capacity will have increased over the current operational and planned 10,000 megawatts by a factor of 5 to 6. It is

also expected that by the year 2000, 63 per cent of Ontario's generating capacity will be nuclear, and that the national figure will be 46 per cent.

FORECAST OF NUCLEAR-ELECTRIC GENERATING CAPACITY
IN CANADA (Megawatts)

Table 2

Period	Ontario	Rest of Canada	Total
to 1980	5,500	600	6,100
1981-85	8,250	4,600	12,850
1986-90	10,650	10,200	20,850
1991-95	13,200	22,400	35,600
1996-00	25,200	33,000	58,200
Total	62,800	70,800	133,600

Source: Ontario Background Papers: Federal-Provincial Conference of First Ministers on Energy, January 1974, p.45.

If Ontario's nuclear generating program goes forward to the end of the century, as projected, the cumulative demand for uranium will be some 85,000 tons. Furthermore, if no change in technology by the year 2000 is assumed, Ontario's installed nuclear capacity at that time will require, during the lifetime of the plant in service, an amount of uranium equal to all currently proven Canadian reserves at a cost of under \$10 per pound.

It seems likely that the U.S. will not be able to meet its own requirements for uranium from domestic sources within the present decade. Demand from other parts of the world is also likely to overtake present supply by the end of the decade. Accordingly, it may be expected that the world price for uranium will increase to the point where exploration is stimulated. However, considerable international pressure on Canadian supplies may be expected also. As a result, Canada, as possessor of a significant part of world reserves, is taking steps to ensure that long-term domestic needs will be met.

Hydro Electricity

In 1960, 99 per cent of energy generated by Ontario Hydro was from hydro electric stations, but by 1972 the figure had dropped to about 54 per cent. In the latter year, installed hydro electric generating capacity in Ontario was 6,117 MW, as compared to a total of 32,500 MW for all of Canada.

It has been estimated that 8,000 to 9,000 MW hydro electric capacity would be added in Ontario either as additions to existing facilities or as new stations. However, development of the only significant remaining source -- The Albany River -- is not believed to be economic at this time.

Studies have indicated that potential hydraulic sites are more likely to be economic if developed for peaking purposes, provided transmission costs are not excessive. However, because peaking power is not needed in large amounts until such time as excess nuclear

energy becomes available in the late 1980's, Ontario Hydro has not included development of hydro electric peaking facilities in its generation program up to 1983.

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